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TRANSISTOR REPORT

OHMMETER TRANSISTOR CHECK

Simple method to check transistor condition

An approximate check on the condition of a transistor may be made with a vacuum-tube type ohmmeter. This method involves checking the transistor as two separate diodes; that is, checking the forward and reverse resistance of each section.

A word of caution: The meter should be a vacuum-tube type. For the forward (low) resistance measure the Rx10 scale must be used. Do not use the Rx1 scale, as damage to the resistor could result. Also do not use a shunt type ohmmeter. The reasons for these precautions is, that some non-electronic ohmmeters use a high internal battery voltage.

The following instructions are for the PNP type transistor. NPN types are checked in similar manner, except that the applied polarities from the ohmmeter are reversed.

With the ohmmeter on the Rx10 scale, connect the negative terminal to the base of the transistor and the positive terminal to the collector and the emiter respectively. This will measure the forward resistance of both sections, and it should be in the order of 500 ohms or less for each side. Then connect the positive terminal to the base and the negative terminal to the collector and emitter respectively. This will measure the reverse resistance of each section and it should be around 50 K or higher. In the event that readings different from these are obtain check to see that the terminals are connected right, and if they are, the tarnsistor is deffective. (Reference: Technician Mag. April 1956)

CLASS 'B' FOR TRANSISTORS

A LOW DISTORTION AUDIO OUTPUT STAGE

The class B circuit to be described is ideal for transistorized itercom, phone amplifier or power output. The performance, excels most comercial circuits. For audio operation, class B offers all the advantages, efficiency is high and distortion can be kept below 2%.

Using push-pull operation, this bridge circuit is a refinement meeting wide acceptance. It is particulary advantageous, for class B operation.

Much of the distortion in class B results from an imperfect output transformer. Since the bridge circuit can either drive a voice coil directly or use a single primary output transformer, these troubles are largely eliminated. However all these cifcuits employ a special split-secondary driver transformer not commercially available. The circuit presented here can be built by anyone. After much searching, a transformer has been found that is just about ideal as a driver for the bridge type of push-pull output stage. The transformer requires a slight modification, but this is very simple and requires only to pull back the outer paper wrap from one side.

Distortion on a typical class B transistor stage increases at near maximum output and at very low level outputs. But the distortion is most severe at low output. For very small driving signals the transistor input resistance is very non linear. Below a certain threshold voltage the transistor does not respond appreciably to any input signal.

Comercial circuits overcame this difficulty with a bias current to lift the transistor out of it's non-linear region. The bias reduces the low level distortion, but it also increaes medium level distortion, places a fixed bleeder current on the power supply and lowers the maximum power capacity of the transistor since the bias causes transsistor heating.

The circuit described here does not use bias to reduce low level distortion; negative feedback is used instead. Feedback reduces distortion at all levels and does not have the power wasting of the bias system.

The efficiecy is so high that in some cases it may be unnecesary to include an on-off switch. With no audio input the amplifier draws an idling current of only 1 ma. When the signal is applied, the amount of current drawn depens on the signal amplitud. With loud signals the current may climb to 20 ma. For these reasons the amplifier is very atractive for intercoms.

Constructing the amplifier:

The three major components are the two transformers and the 160 ufd. electrolitic capacitor. This capacitor need not be so large; any 5 ufd. or higher, rated for 3 volts should be satisfactory. The output transformer has a tap for either 100 or 200 mw. operation. The battery voltage, emitter resistor and shunt capacitor across the output transformer are changed when operation is switched from one power to the other.

The transistors are soldered directly to the terminal lugs.

Feedback is supplied to the driver through the 100 and 10 ohm resistor combination.

The driver transformer modification is as follows: The transformer is an Argonne AR-109. The modification separates the center tapped secondary so the two halves become independent windings. To do this the paper must be cut to expose the center tap and it's connection to the external wire. This connection must be cut and a wire soldered to each side of the windings. When this is done, check and pair off the secondary wires with and ohmmeter. A pair goes to each transistor, one wire goes to the base and the other to the emitter. The pairs should be checked to see that there is no continuity between the windings.

Circuit operation:

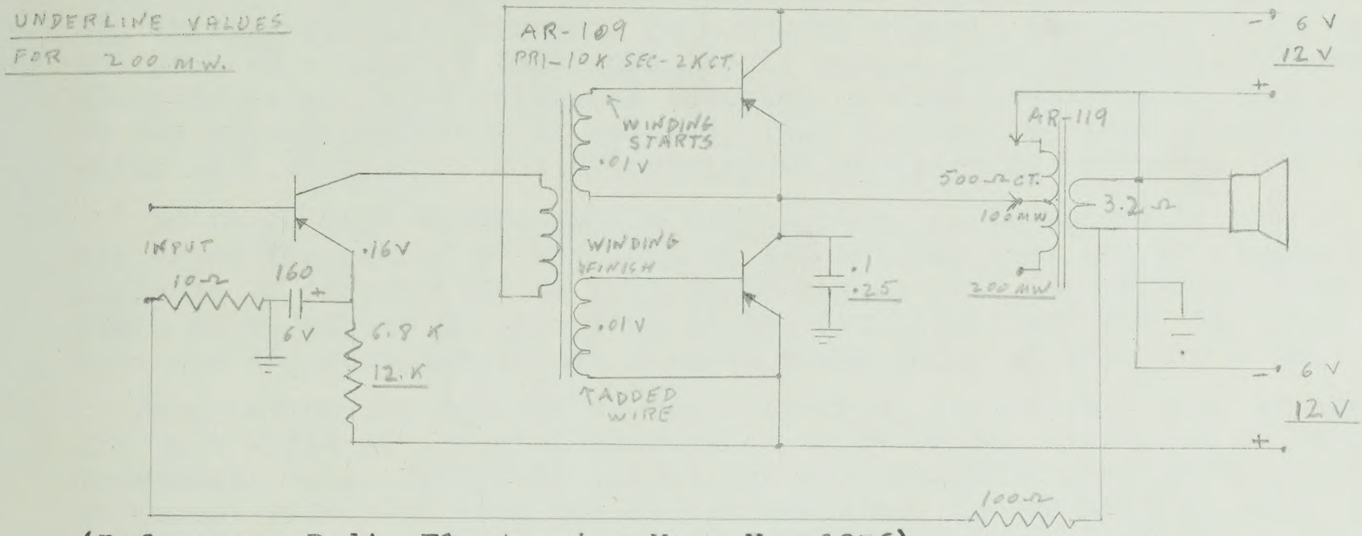
This a basic output circuit. It can be driven by either a preceding transistor stage or a matching transformer. The input impedance is around 3000 ohms. If a low gain transistor is used for driver, 200 mv. of signal produces full output. High gain transistors require less signal. The circuit can be pushed to .25 w. output by increasing the batteries to 16.5 volts. Check voltages are shown on the diagram. These are based on 100mw. operation and with no signal. Allowances can be made from half to twice these values.
Because the driver transformer has low winding resistance, the base to emitter resistance is low enough to obviate the usual stabilization resistors.

To read the current with the signal applied, place a milliammeter in either of the battery leads. The meter in the common lead will indicate how well the output transistors are matched. A current of more than 3 ma. at full signal indicates poor matching. This transistors should be matched. Most PNP transistors are suitable. For example, the CK722. Do not use types that have low power and collector voltage ratings. Several companies offer matched pairs of transistors for class B. These are a little more expensive, but for the extra cost the preformance will be improved tremendously.

Occasionally, this amplifier will oscillate at near-ultrasonic frequencies producing distortion. This can be cured by spacing the input and output wires, Grounding the circuit or placing a 10 K resistor between collector and base of the output transistors.

There is some feeling thet it may be extremely difficult to obtain an output of 200 mw. using CK722 or 2N107's in this circuit. High current transistors are needed for apprecible output. Perhaps the added cost of matched 2N109's or OC72's (Amperex) will be justified by the large increase in power output.

CIRCUIT DIAGRAM OF CLASS B OUTPUT STAGE



(Reference: Radio-Electronics Mag. May 1956)

DYNAMIC TESTING OF PORTABLE TRANSISTOT RADIOS

SIGNAL TRACING; SIGNAL INJECTION; AVC; VOLTAGE; CURRENT AND RESISTANCE TESTS

Dynamic tests speed servicing the transistor radios.
While trouble-shouting a transistor radio is very much like a tube radio there are several precautions that should be taken:
Check the battery voltage with the receiver turned on. Avoid shorting transistor elements, to each other and to circuit ground. Avoid continuity checks with the transistors in the circuit. It is possible to damage the transistor.

Why dynamic tests? The best way to test a transistor is by the substitution method. Failure of a transistor can be attributed to moisture, heat and mishandling. Also external conditions which cause the maximum ratins of voltage and current when the set has been functioning.

A transistor radio with a few exceptions is like a tube radio.
By using either the signal tracing or signal injection method the technician can quickly isolate the trouble.
A good place to start is between the second detector and 1st. AF amplifier. By injecting an AF signal at the output of the detector The audio section can be checked. If the signal does not go through that would indicate that the trouble is between this point and the speaker. Additional check points in this direction would be at the input of the output transistor. If the signal still does not go through, then the output transformer and speaker must be checked. If in the other hand, if the signal went through from the out put of the detector Then the modulated IF frequency should be injected in the input of the first IF stage followed by a check at the output of the last IF stage if necesary. Any signal within the range of the receiver may be used at the antena and input of the RF stage.

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One of the major differences encountered in transsistor radios is the AVC action. The purpose remains the same, to maintain the carrier voltage at the 2nd. detector at the same level, regardless of signal strength.

The polarity of relative terminal voltages, with respect to each other in a NPN transistor is much the same as in a vacuum tube. Under strong signals the base is driven more negative, and the gain is there fore reduced. However, in the PNP type, the relative terminal polarities is reversed and the AVC voltage is also reversed. On a strong signal, the base, which acts like the grid of a tube in this case, would become more positively biased. Regardless of polarity, a voltmeter inserted to read upscale will show variations as the tuning capacitor is rotated. This provides another quick dynamic test which will whether or not everything is functioning up to the 2nd. detector.

If there is a break in the signal path, as indicated by either the signal injecting method or the lack of AVC action, then the IF stages should be checked. If is possible to feed an IF signal from the antenna, then the probable cause of the trouble lies in the oscillator circuit. If after checking voltages and resistances the circuit seems to be OK then try a new transistor.

Oscillation due to lead dress, alignment, and overall gain of the receiver are just a few of the characteristics to be on the alert for in this type of transistor sets. Different transistor will function more efficiently with different values of load resistance and bias. So for best results, when replacing a transistor, the manufacturers specifications should be follow.

(Reference: Technician Mag.)
Feb. 1957